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Wave packet dynamics of atoms in intense laser fields*

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Recent advances in the interpretation of strong, ultra short pulse laser-atom experiments relies on the understanding of the dynamics of the wave packet of highly excited or free electron density created during ionization. An atomic electron promoted into the continuum by an abrupt transition from its initial bound orbital finds itself in a relatively slowly varying, oscillating electric field which dominates it subsequent motion. The field initially pushes the electron away from its parent ion core, then, half the time, accelerates the electron back towards the nucleus. An electron which is rescattered by the ionic potential can either produce high order harmonic radiation by recombining into its initial state, or escape, being further accelerated by the field to become part of a very energetic photoelectron spectrum. A complete analysis of this rescattering dynamics can explain recent, surprising experimental results and this understanding can be exploited to control the ionization dynamics and thus the emission processes. As a consequence it turns out that it is possible to produce sub-femtosecond pulses of VUV and XUV radiation [1]. This would open a new regime in the study of quantum dynamical phenomena.

In this talk the creation and evolution of the continuum wave packet will be discussed and the mechanism for using multiphoton processes to produce short wavelength, ultra-short light sources will be presented.

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